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merely to point out an error into which he is liable to fall. But there is still one other defect necessarily inherent in an exclusively practical *art*, and more especially in our own. The application of the few general principles which we possess to individual cases is so uncertain that it leads to a desponding view of the future progress of our profession. It leads us to despair of ever placing our own science, if indeed it may be called a science, in the proud position occupied by the more certain sciences; it makes us lose sight of that beautiful description of the true philosopher, which one of the truest and most distinguished philosophers of our own time has sketched—the character of hoping all things not impossible, and believing all things not unreasonable. If we must needs despair of the future progress of our art, let us at least have better reasons than those we now possess for indulging our despondency. Let us adopt those strict and rigorous methods of investigation, those clear definitions of the terms we use, those accurate instruments of measurement, the application of which has raised other sciences to such certainty and perfection; and should these fail, then, and not till then, we may safely assume that the structure and functions of the human body are so complicated, and the subtle principle which guides and regulates the human frame so incomprehensible, that steady industry, and patient thought, and subtle and comprehensive reasoning shall, for once in the history of science, be lavished in vain.

ON RAILWAYS IN BELGIUM.

THE attention of the public has been recently attracted to the subject of the establishment of a general system of railways in Ireland, and opinion appears to be much divided as to the policy of the Government interfering either to promote or regulate this undertaking. It would not be fitting in this place to discuss the arguments which have been advanced on both sides of this question; but the experience of the European state which has first adopted a government system of railway communication, may throw some light upon the subject, and in some degree tend to the settlement of a question which is of momentous importance to Ireland, and which, in conjunction with other measures at present in operation, holds out the prospect of great and lasting improvement to that country.

Belgium is the first state in Europe which has established a general system of railways, embracing the whole of the kingdom, and planned and executed by the Government at the public cost. The project was first put forth in the year 1833, and the object proposed was to unite the principal commercial towns on one side with the sea, and on the other with the frontiers of France and Prussia. In this respect Belgium is most favourably situated for the experiment of a general system of railways: it is of a compact form, of moderate extent, surrounded on three of its sides by active commercial nations, and on the fourth by the sea, which separates it only by a few hours' voyage from England. On its western side are the two large and commodious ports of Antwerp and Ostend, and its eastern frontier is only a few leagues distant from the Rhine, by which it becomes united to Southern and Midland Europe. Hence it possesses a near market for its productions,

and offers many facilities for an extensive transit trade. The nature of the country, also, is most favourable, being generally very flat, and requiring but few of those costly works of levelling, tunnelling, and embankment, which have so swollen the expense of similar undertakings in this country.

The first step which the Government took for the accomplishment of its object was, to employ a number of competent engineers to survey the kingdom, and to determine the main lines with reference not only to the general features of the country, but also to the interests of the several large towns, and to their internal and foreign relations. On the 1st of May, 1834, a law was passed authorizing the Government to carry their project into execution. Mechlin was taken as the centre of the system, with four branches extending from that town, in different directions, to each frontier.

Northward,—to Antwerp.

Eastward,—by Louvain, Liège, and Verviers, to the frontiers of Prussia, whence it was expected that it would be continued by a private company to Cologne.

Southward,—through Brussels and the province of Hainault, to the French frontier near Valenciennes.

Westward,—by Dendermond, Ghent, and Bruges, to Ostend.

It appears doubtful whether Brussels or Mechlin is most favourably situated for the central station. The former is the seat of Government, and is in a rather more direct line from Ostend, on the western frontier, to the eastern boundary; but, on the other hand, the line selected through Mechlin passes by more large towns, and the distance between Antwerp and the eastern frontier is rendered much shorter than if the line were carried through Brussels. Other considerations may have tended to influence the choice of the Mechlin line; but it is understood that regret is beginning to arise that Brussels was not made the centre of the system.

The total length of the lines projected by the first law was $239\frac{1}{2}$ English miles, of which $159\frac{1}{2}$ miles, or exactly two-thirds, are already completed.

The several sections were opened at the following periods :—

From Mechlin to Brussels . .	12·61 miles, on 5th May, 1835.
Mechlin to Antwerp . .	14·60 ,, 3rd May, 1836.
Mechlin to Dendermond . .	16·59 ,, 2nd January, 1837.
Mechlin to Louvain . .	14·76 ,, 10th September, 1837.
Louvain to Tirlemont . .	11·03 ,, 22nd September, 1837.
Dendermond to Ghent . .	18·95 ,, 28th September, 1837.
Tirlemont to Waremme . .	16·88 ,, }
Waremme to Ans (near Liège) . .	11·87 ,, } 2nd April, 1838.
Ghent to Bruges . .	27·65 ,, 12th August, 1838.
Bruges to Ostend . .	14·60 ,, 28th August, 1838.

Total . 159·54 Miles

There remain incomplete on the eastern line, the sections from Ans to Verviers; and on the southern line, the sections from Brussels to the French frontier. The minister of public works promises, however, that the latter line will be open as far as Tubise in the present year (1839), and the remainder will probably be completed in 1840 and the following year.

By a subsequent law, dated the 26th of May, 1837, the Government was authorized to extend the system by the construction of a line from Ghent through Courtray to the French frontier, on the road to Lisle, with a branch to Tournay; and by uniting the provinces of Namur, Limbourg, and Luxembourg, to the original system, by means of branch railways. The length of these additional lines will be from 90 to 100 miles. Some of them are already commenced, and two will probably be opened about the middle of the year, namely, the line from Ghent to Courtray, and that from Landen to St. Trond, in Limbourg.

With respect to the line which is to connect the capital of the province of Namur (Namur) to the system, a decree of the 28th of August last, fixes that it shall pass through Vieuville, two miles north of Charleroi, and take the most advantageous course through the provinces of Namur and Hainault to the southern main line. The preferable point of junction appears to be Braine-le-Comte.

Thus the Belgian Government has undertaken the task of establishing a general system of railways in that country, uniting the principal towns in the manner most advantageous to the general interests of the kingdom, without overlooking the particular interest of the several localities. The people have had the advantage of a much earlier introduction of this important means of communication, than if the undertaking had been left to private speculation,—without risk to individuals,—without the interference of private interests,—on lines, perhaps, which of themselves would have offered no temptation to private enterprise, but which as part of an extensive system will repay, either directly or indirectly, the money expended upon them. The Government will, in all probability, recover its outlay from the profits of the undertaking, but will assuredly be repaid by an augmentation of revenue arising from the increased commerce and traffic throughout the kingdom. If it be objected that the Government will be enabled to exercise too despotic a power over the means of public communication, the experience of similar private undertakings in our own country may give rise to a question whether the control of the state is likely to be more absolute than that of the directors of a chartered railroad.

The Belgian Government, however, does not restrain private enterprise upon any other lines than those entering into the general system; and among numerous applications already made it has granted two lines, one of which, the Upper and Lower Flénu, in Hainault, is complete, and the other from Charleroi to Vireux-upon Meuse, on the French frontier, is in course of construction.

All the railways established by the Government, were formed with provision for a double line of rails, but only one line was originally laid down, it being the intention to add a second by degrees, according to the wants of the traffic. Between Brussels and Antwerp, the double line was completed in 1837. The same plan of commencing with a single line has been generally adopted in the United States. This circumstance must be borne in mind in considering the following statement of the expenses of construction.

The cost of the ten sections already completed, comprising the expenses of locomotive power, stations and buildings, was about 1,360,000*l.*, or 8,526*l.* a mile. It appears from an account of the

expenses up to January 1838, that the cost of construction alone amounted to 86·8 per cent. of the sum then expended; and that of locomotives, carriages, stations, and buildings, to 13·2 per cent. The outlay upon each of the six lines open at the latter period, was as follows:—

	Length.	Total Cost.	Average Cost, per Mile.
From Mechlin to Brussels . .	12·61 Miles .	£ 75,716 .	£ 6,004
„ „ Antwerp . .	14·60 „ .	124,775 .	8,546
„ „ Dendermond . .	16·59 „ .	76,044 .	4,583
„ „ Louvain . .	14·76 „ .	108,428 .	7,346
„ Louvain to Tirlemont . .	11·03 „ .	128,628 .	11,661
„ Dendermond to Ghent . .	18·95 „ .	105,784 .	5,582
Total . .	88·54 Miles	£ 619,375	£ 6,995

The cost, however, of the four sections since completed, appears to have been considerably greater, and to have amounted to 10,432*l.* a mile. The expense from Brussels to Antwerp, with a double line of rails, was 7,368*l.* per mile; and that of the four other sections, with a single line, was 6,829*l.* This comparatively greater cost of the latter was owing to the numerous works of art, bridges, viaducts, cuttings, and fillings, and particularly to the tunnel, of 984 yards in length, between Louvain and Tirlemont. It is worthy of notice, that the estimates of the engineers made in 1833 have been exceeded on the above four sections by only 8 per cent.

Let us now compare these results with the cost of similar undertakings in this country, and elsewhere. The lowest sum yet incurred in the construction of a well-executed railway in England, is stated to be 10,000*l.* a mile. This was the amount on the Newcastle and Carlisle, and on the Wigan lines; but of the former only about one-half the length was laid with a double line of rails. Others, however, (exclusive of lines in the vicinity of the metropolis, the cost of which is enormous,) have amounted to 40,000*l.* a mile. The cost of the Manchester and Liverpool line was 38,553*l.* per mile; of the Warrington and Newton, a branch of the latter, 12,470*l.*; of the Leeds and Selby, 10,500*l.*; of the Dublin and Kingstown, 41,823*l.* The short line from London to Greenwich, of only three miles, has cost more than 600,000*l.*, or 200,000*l.* a mile. The estimated cost of the 44 railways for which Acts were obtained in 1836 and 1837, was 25,692,500*l.*; their length, 1,457 miles; and the average estimated cost per mile, 17,600*l.* But judging from the experience furnished by those already executed, this estimate will fall considerably short of the real expense. A striking instance of the insufficiency of the parliamentary estimates is afforded by the London and Birmingham Railway. The estimate was 2,500,000*l.*; the cost, up to 30th June, 1838, has been 4,553,557*l.*, exhibiting an excess over the estimate of 82 per cent.; and a further sum of 500,000*l.* was then required to complete it. The latter amount was leviable upon the shareholders for a portion of the shares not paid up, but it was expected that the debt at the completion of the undertaking would amount to about 2,000,000*l.*, the interest of which must be paid out of the profits before any dividends can be made to the proprietors of shares. This circumstance, however, has had so little influence in discouraging

the public, and the expectation of ultimate profit is so sanguine, that the original shares of 100*l.*, upon which 95*l.* have been paid, are at present (January 1839) quoted at 170*l.*; and the quarter shares of 25*l.*, upon which 5*l.* have been paid, at 29*l.* 5*s.* A similar excess is likely to occur on other lines. On the Great Western it appears, from a recently revised estimate, that the original sum of 2,500,000*l.* will be exceeded by somewhat more than 2,000,000*l.*, and in the present state of the works there cannot be any certainty that this amount will suffice for the completion of the undertaking. It may be difficult to foresee all the contingencies which are likely to arise in the construction of a railway; but some measure appears necessary to prevent so great a discrepancy between the estimates and the actual cost. In France, the estimated expenses of four different projected lines between Paris and Havre, vary from 15,400*l.* to 21,400*l.* a mile. In comparison, therefore, with England or France, Belgium possesses great advantages in the cheap construction of railways; but it falls as far short, on the other hand, of the United States of America. There the cost is stated to fluctuate between 2,000*l.* and 6,000*l.* per mile; and Mr. Porter gives an instance, in the second volume of the "Progress of the Nation" (p. 76), of a railway in that country which cost only 1,312*l.* 4*s.* per mile, and even that amount was greatly enhanced by a change in the mode of construction introduced after the line was completed.

This enormous difference of cost, not only between lines situated in different countries, but between several in this country, constructed under similar circumstances, suggests an enquiry into the causes of such a disproportion. The following have been enumerated as the most prominent:—

1st. Excessive parliamentary expenses incurred through contests carried on during one, two, or even more sessions, in obtaining a Bill. This cause of expense arises out of competition between opposing lines, which is sometimes real, but more frequently fictitious, and is instituted by interested parties, not perhaps in their own names, but in those of the landowners. In many cases this charge alone, even in very long lines, has exceeded 1,000*l.* per mile. The following statement will afford some notion of the sums which have been expended under this head. In some cases the amount contains the expenses of surveying, and other disbursements, which necessarily precede the Act of Incorporation. On the other hand, it exhibits only the costs defrayed by the companies obtaining the Act, exclusive of those incurred by the different parties opposing the Bill in Parliament.

Statement of expenses incurred in obtaining Acts of Incorporation for the following railways:—

London and Birmingham	£72,868	Great North of England	£20,526
Great Western	88,710	Grand Junction	22,757
London and Southampton	39,040	Bristol and Exeter	18,592
Midland Counties	28,776		
Birmingham and Gloucester	12,000	Total	£303,269

The total estimated cost of these eight railways was 11,595,800*l.*; the above item amounted to two and a half per cent. of that sum, or nearly 500*l.* per mile. If the same ratio be applied to the 1,475 miles, for which Acts were obtained in 1836 and 1837, the amount spent in those

two years under this head would be 729,500*l.* The most extravagant, however, of the above cases, has been far surpassed by the charges attending the contest between the parties supporting the five several lines from Brighton to London. The amount has not been published, but it must have been very great; and the event was, that the Government was obliged to employ an official engineer to report upon the several lines, and upon that which appeared to him the most expedient. This source of expense, it is obvious, would be in a great measure avoided by the Government undertaking the responsibility of the undertaking.

2nd. The enormous demands for compensation by proprietors, through, or near, whose land the proposed line passes, and who withhold their assent, till purchased by the Company on the most ruinous conditions. There are instances in which this species of extortion has amounted to 10,000*l.* per mile. One case has recently been the subject of a trial in the Court of Chancery, in which a nobleman in the county of Essex obtained from the Directors of the Eastern Counties Railway, in consideration of his withdrawing his opposition to the bill, 20,000*l.* for land belonging to him required [by the Company;] and 100,000*l.* for the injury done to his estate. It is true that the avowed object of the individual in question was to oblige the company to select another line, and that the purchase might have been avoided by the adoption of that line. The latter course, however, was not followed, and an action having been brought to compel the fulfilment of the contract, the Court decided in favour of the validity of the deed, and the equity of the claim. One of the grounds of his lordship's objections to the railroad passing through his property is worthy of record: the following is a quotation from the Vice-Chancellor's judgment:—"It further appeared from his lordship's affidavit, that his lordship was very partial to the old English amusement of fox-hunting, which was a source of high gratification, not only to himself, but to all the gentlemen in the county. His lordship's high feeling naturally prompted him to stand forward as a champion against any violence of that healthful recreation, in which they had all so long participated." The contrast afforded by the United States of America is very striking. Mr. Fripp, in his account of the New York and Erie Railway (in the present number of this Journal, page 10) mentions, that "besides the support granted by the State Loan, donations of great value have been made to the Company by individuals owning lands on the route of the railway. These donations consist of many thousand acres of land: for instance, 50,000 in one county only, proffered by the proprietors for the purpose of inspiring confidence in the stock, providing for dividends, and the payment of interest, and to secure the speedy construction of the road." The circumstances of the two countries, it is true, are very different, but the fact deserves notice, as it exhibits one of the causes of the superior cheapness in the construction of railroads in the latter country.

A remarkable instance of the prevalence of the same system of extortion in France is afforded by the adjudication of the Jury of Expropriation upon a part of the Versailles and St. Cloud Railway. In one case, the lessee of a field at Versailles demanded 84*l.* for one acre of land, and produced documents, signed by some architects of that place, in support of his estimate. It was, however, reduced by the Jury to 16*l.*

Another proprietor claimed 265*l.* for the suppression of a right of way across his land: the Company offered him 10 francs for it, and the Jury awarded him nothing. The whole amount claimed was reduced from 61,926*l.* to 25,626*l.*

A fair estimate of the proportion which the cost of land and compensation bears to the total expenses of the railway, may be formed from the average results of two of the principal lines already completed: *

	Total Cost.	Land and Compensation.	Per Centage Proportion.	Average.
Grand Junction . . .	£1,512,150	£211,230	14·0 }	13·7
London and Birmingham	4,553,557	622,507	13·7 }	

If the same proportion be applied to the railways which have been actually commenced since the year 1830, and of which the estimated cost amounts to about 40,000,000*l.*, the sum payable to owners of lands and houses will be 5,500,000*l.*; and if one-fourth (a very moderate allowance) be added for deficient estimates, the total amount will be nearly 7,000,000*l.* The effects of the diversion of so large a capital into a new channel, of the unexpected acquisition of a large amount of ready money by the agriculturist, of the destruction of houses in the suburbs of towns, and the impetus thereby given to the building trade, are well worthy of consideration, apart from the other consequences attending the construction and operation of railways.

3rd. Extravagant expenses are often incurred by companies pushing the termini of their lines too far into the centre of towns, and by carrying their lines through towns, in order to effect which it becomes necessary to purchase much valuable property.

4th. Engineers, it is believed, have incurred heavy, and sometimes ruinous, expenses, in order to render their lines mechanically as perfect as possible, without duly considering whether the advantages thus obtained will compensate for the expenditure requisite to produce them. By admitting a certain degree of undulation, accommodated to the natural inequalities of the ground, very large savings may often be effected, without introducing any serious impediments to the working of the lines. It is also in the heavy parts of the work, in cuttings and embankments, that many of those unforeseen and contingent expenses occur, which so frequently cause the actual cost of construction so much to exceed the estimated cost. The Newcastle and Carlisle Railway, which has been already quoted for the economy of its construction, is remarkable for its sinuosities. There are several curves of about a quarter of a mile in radius, and in one part the line runs round the base of a hill, of very moderate diameter, at a less curve probably than any other railway in the kingdom. Adopting these views, the Irish Railway Commissioners found that by a very inconsiderable loss of mechanical power, and without, in any respect, interfering with the working capabilities of their proposed lines, that is to say, without the introduction of any gradients exceeding the limit in their original sections (of 16 feet to a mile), a saving of 31½ per cent. might be effected, or an amount of 1,674,000*l.* on a line of 359 miles. The advantage of this reduction in the neighbourhood of towns may be deduced from the fact, that while

* The exact proportion on the Liverpool and Manchester line cannot be given, but it rather exceeded the above average.

the average saving per mile of the whole distance was estimated at 3,200*l.*, the saving at the entrance into Dublin was calculated at 18,200*l.* per mile, viz.—

	Entrance into Dublin.	Average of the whole.
Original Gradients . .	£52,925	£14,813
Reduced „ . .	34,508	11,639

On the Belgian railways the gradients never exceed 1 in 250. From Louvain to Ans they average 1 in 333, which is the limit adopted above by the Irish Commissioners.

5th. Another source of extravagant expenditure arises from the haste with which these works are frequently pushed forward; which is such, in many cases, as to require day and night work, and many other heavy extra charges.

6th. Short lines are frequently rendered expensive by their requiring a greater proportionate number of stations, warehouses, workshops, and other establishments; those always forming a large item in the general cost of construction.

7th. The nature of the country frequently presents difficulties only to be overcome by an enormous expenditure in the formation of tunnels, cuttings, embankments, bridges, &c.

The Irish Railway Commissioners pronounce a decided opinion, that unless expenses of this nature can be avoided in Ireland, there is but little prospect of a general railway system being attended in that country with either private or national advantage.

It will be observed that most of the causes which have enhanced the cost of railways in this country would be in a great measure avoided, or might be controlled by the Government, if the undertaking were in their hands. But supposing that their influence were merely exerted to suppress the two first causes of expenditure—parliamentary costs, and excessive compensation to proprietors of lands and houses—and the removal of the other causes were left to private judgment, it will be seen that, notwithstanding the difference in the value of land and labour in this country, the expense of constructing a railway in England under ordinary circumstances, which already falls short of that incurred in France, would not much exceed that incurred in Belgium. In this country the cost may be taken at from 10,000*l.* to 12,000*l.* per mile, which has been the actual cost of two lines subject to the expenses already enumerated; in France at 15,000*l.*, and in Belgium at 8,500*l.*, in both of which countries the construction is in the hands of the Government.

We have not the means of comparing the different branches of expenditure in this and foreign countries. Labour, which is the principal portion, is paid higher in England; but it may be doubted whether, as compared with France and Belgium, its superior productiveness will not to a considerable extent diminish this disadvantage. Land also must be much more expensive, particularly under the present system of purchase; but we lie under less disadvantage with respect to materials and mechanical processes.

The estimate of the total expense of the several lines projected by the Belgian Government is as follows, according to the statement put forth in the “*Livret du Chemin de fer de la Belgique*,” published by the Royal Geographical Establishment in Brussels. The cost of a single

line of rails in a level country is taken at 6,950*l.* per mile, and in a hilly or broken country at 8,559*l.*, an increase of 23 per cent.

158 miles completed, at £6,950 per mile £1,097,280 }
 81½ „, unfinished, at £8,559 „, 688,920 } £1,786,200

239½ „, by the law of 1st May, 1834.

37½ „, of level country, at £6,950 per mile . . £259,200 }
 56 „, of hilly country, at £8,559 „, . . . 478,800 } 738,000

93½ „, by the law of 26th May, 1837.

332½ Miles £2,524,200
 To this must be added the cost of engines and carriages, stations, }
 workshops, and buildings, &c., about 14 per cent. . . . } 355,800

Total . . . £2,880,000

This sum averages 8,660*l.* per mile. The extent of the lines proposed by the Irish Railway Commissioners is remarkably approximate—359 miles. Their estimate, with the reduced gradients, is 3,643,353*l.*, averaging 10,150*l.* per mile, or 17½ per cent. more than the Belgian lines.

The carriages on the latter are divided into four classes, the fares of which vary according to the degree of comfort which the conveyances possess. They present a great contrast, as regards amount, with the English fares. The average charge per post league of 4,000 metres, or 4,374 yards, is,—

In Berlins . .	35 c.; equal to 14·08 c., or less than	1½ <i>d.</i> per mile.
Diligences . .	30 „, 12·06 „, „	1¼ <i>d.</i> „,
Chars-à-banc . .	20 „, 8·04 or rather more than	¾ <i>d.</i> „,
Wagons . .	10 „, 4·02 or rather less than	½ <i>d.</i> „,

There are also wagons for the transport of merchandise, but it is only since the commencement of 1838 that heavy goods have been conveyed by this means. Previous to that period not even the carriages of persons travelling by the railway could accompany them; it was necessary to forward them by the ordinary roads.

The following statements will shew how far the Belgian surpass the English railroads in cheapness of fares. In the former country there are four classes of carriages, the cheapest of which is only two-sevenths, or less than one-third of the English, and only four-tenths of 1*d.* per mile. In England there are sometimes not more than two classes, the lowest of which bears a very different and a much higher proportion to the superior carriages. The Manchester and Liverpool Railway affords a favourable opportunity of comparison, as the distance is about the same as that between Brussels and Antwerp; the former being about 30 miles, and the latter 27½ miles. The fares are as follows:—

Liverpool and Manchester, 1837.		
	<i>s.</i>	<i>d.</i>
Mails	6	6
Coaches	5	6
Wagons	4	0

Brussels and Antwerp, 1838.		
	<i>s.</i>	<i>d.</i>
Berlins	2	11
Diligences	2	6
Chars-à-banc	1	8
Wagons	1	0½

On the English line, therefore, the lowest class is nearly two-thirds of the highest, and the rate per mile for the lowest class is equal to the rate of the highest on the Belgian lines, viz.—

Liverpool and Manchester.		
Mails . . .	2½d.	per mile.
Coaches . . .	2½d.	,,
Wagons . . .	1½d.	,,

Average of Belgian Lines.		
Berlins . . .	1½d.	per mile.
Diligences . . .	1½d.	,,
Chars-à-banc . . .	¾d.	,,
Wagons . . .	¾d.	,,

The following are the rates of fares on some other of the English lines:—

Table of Fares, and Rate thereof per Mile, on various Railways.

	Great Western : to Maidenhead, 22 Miles.		London and Birmingham: Whole Distance, 112½ Miles.		Southampton: to Hartley Row, 38 Miles.		Grand Junction: Whole Distance, 88½ Miles.		Newcastle and Carlisle: Whole Distance, 60 Miles.		Greenwich: to Deptford, 3 Miles.		Dublin and Kingstown, 6 Miles.	
	Fares.	Rate per Mile.	Fares.	Rate per Mile.	Fares.	Rate per Mile.	Fares.	Rate per Mile.	Fares.	Rate per Mile.	Fares.	Rate per Mile.	Fares.	Rate per Mile.
<i>1st Class.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>	<i>s. d.</i>	<i>d.</i>
Mail . . .	6 6	3'54	32 6	3'48	..	..	25 0	3'63	11 0	2'20	..	..	..	..
Coach . .	5 6	3'	30 0	3'20	9 0	2'84	21 0	3'05	10 0	20'0	1 0	4'00	1 0	2'00
<i>2nd Class.</i>														
Close . .	4 0	2'18	..	..	..	..	..	..	8 6	1'70	0 6	2'00	0 8	1'33
Open . .	3 6	1'90	20 0	2'16	6 0	1'89	14 0	2'03	7 6	1'50	..	..	0 6	1'00

The above table shews that among the lines having one of their termini in London, the fares are highest on the Birmingham, and lowest on the Southampton, leaving out of consideration the Greenwich line, which, from its difference of length, cannot enter into the comparison. The charge, however, on the Newcastle and Carlisle line is from one-fifth to one-third less than any of the others. It proves also that no uniform principle has guided the directors of railway companies in determining the rates of fares. In general the charge by the second class, or open carriages, is about two-thirds of that by the first class carriages; but this is not the case on the Newcastle and Carlisle line, where the proportion amounts to three-fourths; nor on the Greenwich, upon which line it is only one-half. The most striking fact, however, is, that the cost of construction appears to have no influence whatever upon the fares. There is no difference in this respect (at least in the first class carriages) between the Dublin and Kingstown line, which cost 42,000*l.* a mile, and the Newcastle and Carlisle, which cost 10,000*l.*; and a very slight difference between the Grand Junction, which cost less than 20,000*l.* a mile, and the London and Birmingham, which cost 40,000*l.* The fares also on the Greenwich are the same in amount as those on the Dublin Railway (both short lines), although the distance is only one-half as great: but they bear no proportion to the difference of cost, which was five times greater on the former line. If this element may thus be left out of consideration, on what grounds have the directors proceeded? Simply, it would appear, on that of fixing the highest rate which the public will consent to pay, or upon the principle maintained in the Post-Office, of determining what quantity of traffic will yield as much profit as they require at the rates which they choose to fix, and neglecting or resisting an equivalent increase at a lower rate, because they are unwilling to incur the risk of loss by finding more car-

riages and more extensive accommodation. It is not sufficient to assert that the fares are moderate, and the accommodation adequate to the present traffic. The experience of the railroad system itself, compared with turnpike roads, proves that as the fares are reduced, and the accommodation is extended, the traffic will more than proportionably increase. There can, indeed, be no doubt that if the present high rate of charge be maintained, the monopoly which railways possess will prove a great obstacle to increased travelling. That the directors have little to fear from adopting a system of low fares will appear from the following comparison of the present amount of travelling in England and Belgium.

The Liverpool and Manchester Railroad offers a very favourable comparison for this country, as the intercourse between those two towns is perhaps greater than between any other two places at an equal distance. The number of passengers booked at the Company's offices on that line since its opening has been as follows:—

In 1830 (from 16th September to 30th December)	71,951
1831 (the whole year)	445,047
1832 „	356,945
1833 „	386,492
1834 „	436,637
1835 „	473,849
1836 „	522,991

The population of the towns on this line, exclusive of the adjacent districts, which teem with inhabitants engaged in commerce and manufactures, was, in 1831, Liverpool, 196,694; Manchester, 270,963; Warrington, 19,155;—total, 486,812. This number could not have been less in 1836 than 523,000, which is the number of passengers using the railroad in that year. On an average, therefore, each inhabitant may be supposed to take one trip in a year.

In Belgium the number of passengers booked at Brussels, Mechlin, and Antwerp, inclusive of two intermediate stations, in each year since the opening of these lines, has been as follows:—

	Brussels.	Mechlin.	Antwerp.	Total.
1835 (8 last months)	215,342	206,097	..	421,439
1836 (Antwerp only 8 months)	379,588	265,048	226,671	871,307
1837	475,155	364,317	305,995	1,145,467
1838 (10 months)	511,326	338,351	299,146	1,148,823

The population of these three towns did not, in 1838, amount to one-half of that on the English line, namely, Brussels, with its suburbs, 134,302; Mechlin, 22,895; Antwerp, 75,363;—total 232,960; and neither the population nor the commercial activity of the surrounding districts can be compared with those of its competitor, yet the intercourse in 1837 was more than twice as great, and with reference to the difference of population, was five times as great, the average number of trips to each inhabitant having been five per annum. A comparison with the intercourse on both lines previous to the formation of the railroads is equally favourable to the Belgian undertaking. On the Liverpool and Manchester line the average number of passengers which the coaches carried, in the year 1825, was estimated at 450 daily, or 164,250 per annum. The number actually conveyed by the railroad, in 1836, was 523,000, shewing an increase of 218 per cent., or rather more than three times the former number; the fares having been reduced

from 10s. and 6s. to 5s. 6d. and 4s.: the higher rates one-half, and the lower only one-third. On the Belgian line the number of passengers between Brussels and Antwerp, before the opening of the railway, is said to have been 80,000 yearly. The rates of conveyance have been reduced from 4s. and 2s. 6d. to 2s. 6d. and 1s. 0½d.; the higher fares two-fifths, and the lower three-fifths: and in 1837 the number of passengers booked at Brussels and Antwerp, excluding Mechlin, whence a portion of the passengers were proceeding on other lines of railway, was 781,250, shewing an increase of 876 per cent., or about nine and a half times the former number. If Mechlin be included, the increase will be fourteen times the former number. An analysis of the classes of travellers will shew that this superior activity is in a great measure owing to the cheapness of fares. Of the total number of passengers, during the 6 months ended 30th October, 1836, the proportion using each class of carriages was as follows:—

Berlins,	paying	2s. 11d.	1.7	per cent.,	yielding a revenue of	5	per cent.
Diligences	„	2s. 6d.	3.7	„	„	9	„
Chars-à-banc	„	1s. 8d.	22.2	„	„	32	„
Wagons	„	1s. 0½d.	72.4	„	„	54	„
			100.				
						100.	

The proportion of persons travelling short distances only in wagons is still greater, but the above is sufficient to shew how large a portion of the whole revenue of the Company is derived from passengers of the lower class, paying a very small fare; and it is a just inference that the high rates of fares on the Liverpool and other railroads in England do very materially check travelling; that to the artisan they entirely prohibit travelling for pleasure; that they restrain even the wealthy in the use of this source of recreation; and it can scarcely be doubted that they interfere with journeying on business. Whether an increase of numbers at a low rate would repay the corresponding additional outlay for locomotive power, wear and tear, &c., is another question, upon which the evidence afforded by the Belgian Railway is also important. The following result of the operations on all the lines since they were severally opened, tends to shew that the experiment has been successful.

			Expenses.	Receipts.	Excess of Receipts.
1835	1 Section open 8 Months		£ 6,748	£ 10,756	£ 4,008
1836	{ 1 „ 4 „ }		17,244	33,004	15,760
	{ 2 „ 8 „ }				
1837	{ 3 „ 6 „ }		46,216	56,676	10,460
	{ 8 „ 4 „ }				
1838	{ 6 „ 3 „ }				
	{ 8 „ 4 „ }		64,768	105,340	40,572
10 Months.	{ 10 „ 3 „ }				

The cost of these 10 sections, including the materials, was about 1,360,000*l.*, the interest of which sum, at 5 per cent. per annum, would amount to 68,000*l.*; and for 10 months, to compare with the above, it would be 56,667*l.* But it must be borne in mind, that the whole of the ten sections were only in operation during three months, and therefore the profits of 1838 must not be charged with the cost of all the sections. The receipts at Ans, which section was only open seven months, amounted to nearly one-third of those at Brussels during ten months, and the line from Bruges to Ostend was not open three months. The following were the receipts at each principal town:—

Brussels . . .	£29,882	Louvain . . .	£7,728
Antwerp . . .	16,553	Tirlemont . . .	4,218
Ghent . . .	13,114	Ostend . . .	1,607
Mechlin . . .	11,640	Other Towns . .	11,027
Ans . . .	9,571		

This statement sufficiently indicates the favourable prospects of the undertaking.

With reference to the amount of profit which the Belgian Government looks forward to receiving from the railways, it is necessary to state the view which they take of their position as proprietors. The undertaking might be prosecuted upon three different systems.—1st, As a work of public utility, without requiring that the receipts should cover the expenditure. 2nd, As a financial resource, and requiring that the receipts should exceed the expenditure, and yield an income for public purposes, like the Post-Office in England. 3rd, As an establishment which should neither be a burthen nor a source of revenue, and requiring merely that it should cover its own expenses, consisting of the charge for maintenance and repairs, with a further sum for the interest and gradual redemption of the invested capital. The Belgian Government adopts the last system, and expects to realize an annual profit of 5 per cent. upon the original outlay beyond the current expenses. It has, however, been estimated, that the line from Brussels to Antwerp will yield 16 per cent.

From a comparison of the receipts and expenses, it appears that the latter amounted, in the first 10 months of 1838, to 61 per cent. of the former. In the last 6 months of 1833, the disbursements on the Liverpool and Manchester Railway amounted to 58 per cent. upon the gross receipts, which is stated to be a higher rate than is usually calculated by railway projectors, and is attributed to the necessity of keeping up large warehousing establishments for receiving, housing, dispatching, and distributing goods. The carriage of goods on the Belgian railways was commenced, but only partially, in 1838. As, however, so large a portion of the lines opened in that country have been only a few months in operation, it would not be fair to draw any unfavourable inference from the comparison.

The following statements will shew the progress of travelling on the several lines since their opening. It has been deemed advantageous to distinguish the several subordinate stations, because they all came into operation at different periods, and it would not otherwise be possible to display the increased intercourse of the more important towns.—(See Table, next page.)

If one-fifth be added to the year 1838, to complete the remaining two months, the total for that year will be 2,305,941.

Only three stations have been established long enough to admit of a comparison of the annual increase in the number of travellers. They are as follows :—

	Mechlin.	Brussels.	Antwerp.
Per centage Increase in { 1837 . . .	37	54	..
{ 1838* . . .	11	36	..
,, Decrease .. .	..	..	1 $\frac{1}{5}$

The number of travellers from Antwerp in 1838 has somewhat

* After adding one-fifth for the last two months.

decreased, in comparison with the preceding year; but it must be observed, that at the first opening of a railway the novelty generally attracts a number of passengers, causing an excess in the first few months, and a subsequent falling off, which is not recovered until the line comes into full operation, and its benefits become generally felt and appreciated.

Table of the Number of Passengers booked at each Station on the Railways of Belgium in each Year since their opening.

STATIONS.	When opened.	Number of Travellers booked at each Station.			
		1835 8 Months.	1836	1837	1838 10 Months.
Mechlin . . .	. .	206,097	265,048	364,317	338,351
<i>Southern Line.</i>					
Brussels . .	. .	215,342	370,152	391,428	443,284
Vilvorde . .	November, 1836	..	9,436	83,727	68,042
<i>Northern Line.</i>					
		215,342	379,588	475,155	511,326
Antwerp . .	May, 1836 . .	..	226,671	300,920	245,999
Duffel . . .	November, 1837	..	..	5,075	53,147
<i>Western Line.</i>					
		..	226,671	305,995	299,146
Dendermond .	January, 1837	..	..	92,841	67,449
Wetteren . .	September , ,	..	..	16,835	35,945
Ghent . . .	, , , ,	..	..	40,102	165,163
Cappelle . .	November , ,	..	..	2,817	29,557
Audeghem . .	December , ,	..	..	639	13,785
Bruges . . .	August, 1838	..	..	..	31,153
Aeltre . . .	, , , ,	..	..	..	6,348
Landegem . .	, , , ,	..	..	..	2,899
Blommendael .	, , , ,	..	..	..	2,166
Ostend . . .	September, 1838	..	..	..	19,390
Jabbeke . . .	, , , ,	..	..	..	1,755
<i>Eastern Line.</i>					
		..	..	153,234	375,610
Louvain . . .	September, 1837	..	..	57,669	161,221
Tirlemont . .	, , , ,	..	..	25,566	80,292
Haegt . . .	November , ,	..	..	1,594	19,052
Vertryck . .	, , , ,	..	..	1,047	7,731
Waremmes . .	April, 1838 . .	..	..	..	31,398
Ans . . . .	, , , ,	..	..	..	80,507
Landen . . .	, , , ,	..	..	..	10,348
Fexhe . . . .	, , , ,	..	..	..	6,637
		..	..	85,876	397,186
. Total . . .		421,439	871,307	1,384,577	1,921,614

The months in which most travelling takes place in Belgium are August and September; the least occurs in January and February, as will be seen by the following aggregate of the number of passengers booked at Mechlin and Brussels, in each month, during three complete

years; at Antwerp during two years; at Ghent, Louvain, and four other stations during one year.

January . . .	173,189	July . . .	382,374
February . . .	164,661	August . . .	474,557
March . . .	218,802	September . . .	422,546
April . . .	261,026	October . . .	326,847
May . . .	323,878	November . . .	192,753
June . . .	352,924	December . . .	188,069

The receipts have already been stated. Of the amount in 1837, 680*l.* was received for extra baggage, of which only 20 kilogrammes, or 44 lbs. English, is allowed to each traveller; and in 1838, 3,338*l.* arose from the same source, and 1,768*l.* from the transport of merchandise. The rate of charge upon extra baggage and merchandise is the same, namely, from Brussels to Antwerp, a distance of $27\frac{1}{2}$ miles, 1 fr. 60 c. per 100 kilogrammes, which is equivalent to 13*s.* $4\frac{3}{4}$ *d.* per ton, or $5\frac{1}{2}$ *d.* per mile. The rate per mile by the London and Birmingham Railway is 6*s.* 6*d.* per cwt. for the whole distance, or nearly 1*s.* 2*d.* per mile for a ton, which, however, includes delivery and all charges except booking in London.

There is still another point in which the Belgian railways surpass those of this country, namely, evenness of motion; but it remains to be seen how far the carriage of heavy goods, which has only lately been commenced, will diminish this advantage. Mr. Loch, in a letter addressed to Lord Morpeth, and printed in the Appendix to the Irish Railway Report, says upon this point, that “the motion is much more equal and uniform on the Brussels Railway, and there is far less (I had almost said there is none) of that thumping which distinguishes the Greenwich, as well as the Liverpool Railway. The carriages are neater within, and better finished; and they have none of that disagreeable swinging motion which the English carriage has, and which is so much remarked upon. Coupled with this, the breakage of the rails amounts to nothing on the Brussels Railway, while it is so tremendous upon the Liverpool. Upon the former not above a dozen have been broken since it was opened (20 months), whereas the number upon the Liverpool amounted to 18 for the week ended 21st of January, 1837, and 12 for the week preceding. The velocities on each vary but little; the difference, however, is in favour of the Liverpool. The original rails on this road, and on the Brussels, are in weight nearly the same. The latter line has wooden sleepers throughout, and the road appears to have a certain degree of elasticity.”

The velocity on the Belgian lines is, in general, from 26 to 30 miles an hour; which is diminished at the bridges, tunnels, stations, &c. These and the other necessary delays make the average rate 20 miles an hour.

The locomotive engines in use were manufactured by Mr. Stephenson, at Newcastle, and Mr. Cockerill, at Seraing: they are of different power, the diameter of their cylinders varying from 11 to 14 inches. They have generally only two driving-wheels, but a few have four: 28 carriages are fixed by law as the largest double train with two engines; from 14 to 18 as the number for a single engine.

There remains only to shew the nature of the expenses of working the lines, divided into the principal branches. The total expenditure

under this head, from the opening of the first line to the end of October, 1838, was 134,981*l.*, of which there was for—

Maintenance and Police of the Line	£36,274 = 27 per cent.
Expenses of Carriage	76,379 = 57 „
„ Collection	22,328 = 16 „

Total . . £134,981

The accounts for the first ten months of 1838 enter more into detail, of which the following is an abridgment:—

Maintenance and Police:—	£.	
Wages of labour	13,856	
Materials	604	
Salaries	652	
	<hr/>	15,112
Expenses of Carriage:—		
Wages of labour	12,700	
Salaries	1,317	
Labour at coke furnaces	696	
Materials for consumption	19,945	
„ repairs, &c.	3,518	
	<hr/>	38,176
Expenses of Collection:—		
Wages; transport of baggage	1,742	
Salaries of officers	8,145	
Miscellaneous	1,592	
	<hr/>	11,479
Total	£64,767	

Among the materials for consumption, coal, coke, and wood amounted to the large sum of 17,520*l.*

As merchandise has not, until the past year, been admitted on the Belgian railways, their influence upon the traffic and commerce of that country cannot hitherto have been considerable. This further development is necessary to complete the system, and to enable us to judge of its full effects. Enough, however, has been advanced to demonstrate its plan and extent of operation—its prospects of success—its points of difference and of superiority in comparison with the system adopted in this country; and to afford some information which may be useful in the consideration of the important question as to how far it is desirable or expedient that Government shall interfere in the establishment of a general system of railways in Ireland. The objects to be desired in the formation of such a system are, first, the selection of the lines most advantageous to the country at large; and, secondly, the construction of the work at the cheapest rate consistent with its proper execution; the end aimed at is the extension of the traffic and communication of the country to the utmost limits of the public capabilities, at the lowest rate of charge at which the original outlay can be reimbursed. In the preceding statement a comparison has been drawn between the operation of a system undertaken by the Government, as in Belgium, and those of a system left to individual enterprise in this country. The result is certainly favourable to the former; it remains for others to determine how far a similar system is applicable to Ireland, and whether any circumstances exist in the condition of that country which would render its adoption inexpedient.

R.